Disaccharidasen van de mens

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SUMMARY

In Chapter I the occurrence of the disaccharidases – lactase, sacrase, maltase, isomaltase and trehalase – in the human small intestinal mucosa was described. Firstly the structure of the small intestinal mucosa in relation to the localisation of these enzymes was reviewed, and then also the occurrence of primary and secondary disaccharidase deficiencies with the consequences of these disturbances on the health of the patients. A literature survey of studies concerned with the number of disaccharidases and their properties was presented.

In Chapter II the methods were described, which were used to determine disaccharidase activities in biopsy samples of the small intestine. Subsequently methods were given which were used for the preparation and purification of mucosal enzymes, and for the study of their properties. The preparation of isomaltase was described in detail as it was not possible to obtain a sufficiently pure sample commercially.

In Chapter III the results of disaccharidase determinations on patients were presented. From determinations made on a large number of biopsies, normal values were derived. Results obtained for patients having either a primary hereditary sucrase deficiency or a secondary deficiency were described. In patients with a hereditary sucrase intolerance a complex enzyme (maltase II) was missing, which had sucrose, isomaltase and maltase activities. In these patients the ability to hydrolyse sucrose and isomaltose is almost completely lost, however because another maltase (maltase I) is also present, the maltase activity is still about 40% of its normal level. The lactase activity is normal.

In Chapter IV results were reported for the preparation and purification of disaccharidases, using differential centrifugation, solubilisation by papain treatment and column chromatography. A purification was achieved of about 35 fold for the enzyme activity expressed per milligram of protein.

It was apparent from the results of various forms of column chromatography that the human intestinal mucosa contains just one lactase but two maltases, called maltase I and maltase II. Maltase I has activity towards maltose, and also glucamylase activity towards polysaccharides such as starch and glycogen. Maltase II is a complex enzyme with activity towards maltose, isomaltose and sucrose. Maltase I and maltase II could be distinguished from each other by such properties as heat stability, molecular weight and K_m for maltose. This is in contradiction to the classification of Dahlqvist and of Auricchio, who used heat stability to distinguish four and five different

maltases respectively. However it is considered that the behaviour of enzymes to heat denaturation is not by itself sufficient evidence for the existence of multiple forms.

In Chapter V differences between the disaccharidases mentioned above are described. Particular attention is given to differentiate between the activities of maltase II: the isomaltase activity can be denatured by heating and inhibited by palatinose to a much greater extent than the sucrase activity. The sucrase activity, on the other hand, is more sensitive to urea and Hg^{++} ions than the isomaltase activity. The maltase activity is denatured at a rate intermediate between isomaltase and sucrase in all cases. Most of the observed phenomena can be explained by assuming at least two active centers in maltase II, one having activity towards isomaltose and maltose and the other having activity towards sucrose and perhaps towards maltose, but if so to a lesser extent.